What is claimed is:

1. A method for operating an atomic clock comprising the steps of:

a. optically pumping atoms into a ground-state sublevel of maximum or minimum spin from which end resonances can be excited;

b. simultaneously exciting a microwave end resonance and a Zeeman end resonance from a same end state of the atoms either by:

pumping the atoms with constant-intensity, circularly-polarized optical pumping light and applying two alternating magnetic fields, one of the alternating magnetic fields oscillating at a microwave frequency of the microwave end resonance and the other of the alternating magnetic fields oscillating at a radio frequency of the Zeeman end resonance, or

pumping the atoms with modulated circularly-polarized optical pumping light simultaneously modulated at the frequency of the microwave end resonance and at the frequency of the Zeeman end resonance to produce coherent population trapping resonances; and

c. detecting that the microwave end resonance and Zeeman end resonance have been excited.

2. The method of claim 1 wherein in step c., the detection of the microwave end resonance and the Zeeman end resonance is through changes in the attenuation of the optical pumping light.

3. The method of claim 1 wherein in step c., the detection of the microwave end resonance and the Zeeman end resonance is through changes in the fluorescent emission of the light by the atoms.

4. The method of claim 1 wherein the microwave frequency and Zeeman frequency are a harmonic or subharmonic of a local oscillator frequency, to provide a ratio of the microwave frequency and the Zeeman frequency which is a fixed ratio of integers for defining a fixed value of a total magnetic field which is the clock field and a fixed value of the local-oscillator frequency which is a clock frequency.

5. The method of claim 4 further comprising the step of:

applying an adjustable magnetic field to the atoms to produce a clock field which is a substantially constant total field.

6. The method of claim 5 further comprising the step of:

adjusting the local-oscillator frequency and the applied adjustable magnetic field to maximize amplitudes of the microwave end resonance and Zeeman end resonance.

7. The method of claim of 6 further comprising the steps of:

dithering the local-oscillator frequency at an oscillator-dither frequency; and

dithering the applied adjustable magnetic field at a distinct field-dither frequency to generate error signals in the amplitudes of the microwave end resonance and Zeeman end resonance for correcting drift of a local-oscillator frequency from the clock frequency and for correcting drift of a total of ambient magnetic field and adjustable magnetic field from the clock field.

8. The method of claim 1 wherein the atoms are pumped with circularly polarized light at the resonance wavelength for the atoms.

9. A system for operating an atomic clock comprising:

means for optically pumping atoms into a ground-state sublevel of maximum or minimum spin from which end resonances can be excited;

means for simultaneously exciting a microwave end resonance and a Zeeman end resonance from a same end state of the atoms using either:

means for pumping the atoms with constant-intensity, circularly-polarized optical pumping light and applying two alternating magnetic fields, one of the alternating magnetic fields oscillating at a microwave frequency of the microwave end resonance and the other of the alternating magnetic fields oscillating at a radio frequency of the Zeeman end resonance, or

means for pumping the atoms with modulated circularly-polarized optical pumping light simultaneously modulated at the frequency of the microwave end resonance and at the frequency of the Zeeman end resonance to produce coherent population trapping resonances; and

means for detecting that the microwave end resonance and Zeeman end resonance have been excited.

10. The system of claim 9 wherein the detection of the microwave end resonance and the Zeeman end resonance is through changes in the attenuation of the optical pumping light.

11. The system of claim 9 wherein the detection of the microwave end resonance and the Zeeman end resonance is through changes in the fluorescent emission of the light by the atoms.

12. The system of claim 9 wherein the microwave frequency and Zeeman frequency are a harmonic or subharmonic of a local oscillator frequency, to provide a ratio of the microwave frequency and the Zeeman frequency which is a fixed ratio of integers for defining a fixed value of a total magnetic field which is the clock field and a fixed value of the local-oscillator frequency which is the clock frequency.

13. The system of claim 12 further comprising:

means for applying an adjustable magnetic field to the atoms to produce a clock field which is a substantially constant total field.

14. The system of claim 13 further comprising:

means for adjusting the local-oscillator frequency and the applied adjustable magnetic field to maximize amplitudes of the microwave end resonance and Zeeman end resonance.

15. The system of claim of 14 further comprising:

means for dithering the local-oscillator frequency at an oscillator-dither frequency; and

means for dithering the applied adjustable magnetic field at a distinct field-dither frequency to generate error signals in the amplitudes of the microwave end resonance and Zeeman end resonance for correcting drift of a local-oscillator frequency from the clock frequency and for correcting drift of a total of ambient magnetic field and adjustable magnetic field from the clock field.

16. The system of claim 9 wherein the atoms are pumped with circularly polarized light at the resonance wavelength for the atoms.

17. A method for operating a magnetometer comprising the steps of:

a. optically pumping atoms into a ground-state sublevel of maximum or minimum spin from which end resonances can be excited;

b. simultaneously exciting a microwave end resonance and a Zeeman end resonance from a same end state of the atoms either by:

pumping the atoms with constant-intensity, circularly-polarized optical pumping light and applying two alternating magnetic fields, one of the alternating magnetic fields oscillating at a microwave frequency of the microwave end resonance and the other of the alternating magnetic fields oscillating at a radio frequency of the Zeeman end resonance, or

pumping the atoms with modulated circularly-polarized optical pumping light simultaneously modulated at the frequency of the microwave end resonance and at the frequency of the Zeeman end resonance to produce coherent population trapping resonances; and

c. detecting that the microwave end resonance and Zeeman end resonance have been excited.

18. The method of claim 17 wherein in step c., the detection of the microwave end resonance and the Zeeman end resonance is through changes in the attenuation of the optical pumping light.

19. The method of claim 17 wherein in step c., the detection of the microwave end resonance and the Zeeman end resonance is through changes in the fluorescent emission of the light by the atoms.

20. The method of claim 17 wherein the microwave frequency and Zeeman frequency are a harmonic or subharmonic of a local oscillator frequency, to provide a ratio of the microwave frequency and the Zeeman frequency which is a fixed ratio of integers for defining a fixed value of the total magnetic field which is the compensated field and the local-oscillator frequency which is a compensated frequency.

21. The method of claim 20 further comprising the step of:

applying an adjustable magnetic field to the atoms to produce a compensated field which is a substantially constant total field.

22. The method of claim 21 further comprising the step of:

adjusting the local-oscillator frequency and the applied adjustable magnetic field to maximize amplitudes of the microwave end resonance and Zeeman end resonance.

23. The method of claim of 22 further comprising the steps of:

dithering the local-oscillator frequency at an oscillator-dither frequency; and

dithering the applied adjustable magnetic field at a distinct field-dither frequency to generate error signals in the amplitudes of the microwave end resonance and Zeeman end resonance for correcting drift of a local-oscillator frequency from the compensated frequency and for correcting drift of a total of the ambient magnetic field being measured and adjustable magnetic field from the compensated field.

24. The method of claim 17 wherein the atoms are pumped with circularly polarized light at the resonance wavelength for the atoms.

25. A system for operating a magnetometer comprising:

means for optically pumping atoms into a ground-state sublevel of maximum or minimum spin from which end resonances can be excited;

means for simultaneously exciting a microwave end resonance and a Zeeman end resonance from a same end state of the atoms using either:

means for pumping the atoms with constant-intensity, circularly-polarized optical pumping light and applying two alternating magnetic fields, one of the alternating magnetic fields oscillating at a microwave frequency of the microwave end resonance and the other of the alternating magnetic fields oscillating at a radio frequency of the Zeeman end resonance, or

means for pumping the atoms with modulated circularly-polarized optical pumping light simultaneously modulated at the frequency of the microwave end resonance and at the frequency of the Zeeman end resonance to produce coherent population trapping resonances; and

means for detecting that the microwave end resonance and Zeeman end resonance have been excited.

26. The system of claim 25 wherein the detection of the microwave end resonance and the Zeeman end resonance is through changes in the attenuation of the optical pumping light.

27. The system of claim 25 wherein the detection of the microwave end resonance and the Zeeman end resonance is through changes in the fluorescent emission of the light by the atoms.

28. The system of claim 25 wherein the microwave frequency and Zeeman frequency are a harmonic or subharmonic of a local oscillator frequency, to provide a ratio of the microwave frequency and the Zeeman frequency which is a fixed ratio of integers for defining a fixed value of the total magnetic field which is the compensated field and a fixed value of the local-oscillator frequency which is a compensated frequency.

29. The system of claim 28 further comprising:

means for applying an adjustable magnetic field to the atoms to produce a compensated field which is a substantially constant total field.

30. The system of claim 29 further comprising:

means for adjusting the local-oscillator frequency and the applied adjustable magnetic field to maximize amplitudes of the microwave end resonance and Zeeman end resonance.

31. The system of claim of 30 further comprising:

means for dithering the local-oscillator frequency at an oscillator-dither frequency; and

means for dithering the applied adjustable magnetic field at a distinct field-dither frequency to generate error signals in the amplitudes of the microwave end resonance and Zeeman end resonance for correcting drift of a local-oscillator frequency from the compensated frequency and a total of the ambient magnetic field being measured and adjustable magnetic field from the compensated field.

32. The system of claim 25 wherein the atoms are pumped with circularly polarized light at the resonance wavelength for the atoms.